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**Stainless steels for general purposes — Part 4: Bright products**

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO ~~documents~~document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)~~www.iso.org/directives~~).

~~Attention is drawn~~ISO draws attention to the possibility that ~~some of the~~elements~~implementation~~ of this document may ~~be involve~~the subject of (a) patent(s). ~~ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).~~

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

This first edition of ISO 16143-4, together with ISO 683-7, cancels and replaces ISO:683-18:2014, which has been technically revised.

The main changes are as follows:

- ~~former standard~~ ISO 683-18 was split into ISO 683-7 for non-alloy and alloy steels and into ISO ~~—~~16143-4 for stainless steels;
- three austenitic steel grades, three austenitic-ferritic steel grades, two ferritic steel grades and ~~two~~ martensitic steel grades were added;
- ~~Definition~~definition for out-of-round was modified with two new definitions on ovality and out-of-shape;
- editorial ~~revised~~revision.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

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# Stainless steels for general purposes — Part 4: Bright products

## 1 Scope

This document specifies the technical delivery requirements for bright products made of stainless steels in the form of bars in the drawn, peeled/turned or additionally ground condition and they are intended for mechanical purposes, for example for machine parts, and/or for use at high temperature including creep-resistant applications.

NOTE 1 Bright steel products made of corrosion-resistant stainless steel are manufactured from steels mentioned in ISO 16143-2, and bright steel products intended for high-temperature purposes are manufactured from steels mentioned in ISO 4955.

NOTE 2 Further steel grades are suitable for manufacturing bright products listed in other standards, e.g. ISO 15510. They can also be used, but in this case the mechanical properties ~~are to~~ shall be agreed at the time of enquiry and order.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404, *Steel and steel products — General technical delivery requirements*

ISO 4885, *Ferrous materials — Heat treatments — Vocabulary*

ISO 4948-1, *Steels — Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition*

ISO 4948-2, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

ISO/TS 4949, *Steel names based on letter symbols*

ISO 4955, *Heat-resistant steels*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

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ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ISO 6929, *Steel products — Vocabulary*

~~ISO/TR 9769, *Steel and iron — Review of available methods of analysis*~~

ISO 10474, *Steel and steel products — Inspection documents*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 15510, *Stainless steels — Chemical composition*

ISO 16143-2, *Stainless steels for general purposes — Part 2: Corrosion-resistant semi-finished products, bars, rods and sections*

~~EN 10308, *Non-destructive testing — Ultrasonic testing of steel bars*~~

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 377, ISO 4885, ISO 4948-1, ISO 4948-2, ISO 4955, ISO 6929, ISO 14284, ISO 15510, ISO 16143-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

**3.1 bright product**  
drawn or peeled/turned product with smoother surface quality and better dimensional accuracy in comparison to hot-rolled product

**3.2 drawn product**  
product of various cross-sectional shapes obtained, after descaling, by cold drawing of a hot-rolled product, on a drawing bench (cold formation without removing material)

Note 1 to entry: This operation gives the product special features with respect to shape, dimensional accuracy and surface finish. Products in lengths are delivered straightened, products of small cross-section may also be supplied in coils.

**3.3 peeled/turned product**  
round bar produced by peeling or turning where the product can be further processed by straightening and polishing

Note 1 to entry: This operation gives the bar special features with respect to shape, dimensional accuracy and surface finish. The removal of metal is carried out in such a way that the bright product is generally free from rolling defects and surface decarburization.

**3.4 product in the ground condition**  
ground product



drawn or peeled/turned round bar given an improved surface quality and dimensional accuracy by grinding or by grinding and polishing

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### 3.5 thickness

nominal dimension of the product

Note 1 to entry: That means:

- a) the diameter in the case of rounds;
- b) the lateral length in the case of squares;
- c) the width over flats in the case of hexagons;
- d) the shorter lateral length in the case of flats (rectangular bars) and wide-flats.

For special sections, 'thickness' ~~has to~~ shall be defined at the time of enquiry and order.

### 3.6 ovality

difference between the smallest and largest dimension measured across the pairs of opposing points at a common cross-section

### 3.7 out of shape

~~any~~ deviation from the nominal section profile, ~~e. g.: parallelism~~

EXAMPLE Parallelism, perpendicularity and twist.

### 3.8 ruling section

that section for which the specified mechanical properties apply

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Note 1 to entry: Independent of the actual shape and dimensions of the cross-section of the product, the size of its ruling section is always given by a diameter. This corresponds to the diameter of an "equivalent round bar". That is a round bar which will show the same cooling rate as the actual ruling section of the product concerned at its position for taking the test pieces, when being cooled from austenitizing temperature.

### ~~3.8.9~~ stainless steel

steel with at least 10,5% ~~Cr and maximum 1,2% C~~

~~SOURCE: ISO 15510~~

### ~~3.8~~ corrosion resistant steel

~~steel with at least 10,5% (mass fraction) Cr and a maximum of 1,2% (mass fraction) C for which~~  
~~resistance~~ Note 1 ~~to corrosion is of primary importance~~

~~SOURCE: ISO 16143-2~~

### ~~3.8~~ heat resistant steel

~~heat resistant~~ entry: For the classification of stainless steels of this International Standard are used at above 550°C (wustite point) due according to their excellent resistance to the effects of hot gases and products of combustion, as well as their resistance to the influence of molten salts and molten metals but also showing good mechanical

~~properties during short and long-term stressing structure, composition and application, see ISO 15510:2014, Annex C.~~

[SOURCE: ISO 4955

### ~~15510:2014, 3.8 creep resistant steel~~

~~steels, nickel or cobalt alloys with a minimum of 8% chromium, which are characterised by good mechanical behaviour at temperatures above 500 °C under long-range service conditions, i.e. primarily by creep strength to 1% plastic strain or creep rupture strength during long-time stressing]~~

~~SOURCE: ISO 4955~~

## 5.4 Classification and designation

### 5.14.1 Classification

The classification of the relevant steel grades is allocated in accordance with ISO 4948-1 and ISO 4948-2. Stainless steels covered by this document are further classified according to their structure into

- austenitic steels,
- austenitic-ferritic steels,
- ferritic steels,
- martensitic steels, or
- precipitation-hardening steels.

### 5.24.2 Designation

For the steel grades covered by this document, the steel names given in the relevant tables are allocated in accordance with ISO/TS 4949.

NOTE- Designation of steels covered by this document and of comparable grades covered in various other designation systems are given in Annex E.

## 6.5 Information to be supplied by the purchaser

### 6.15.1 Mandatory information

The manufacturer shall obtain the following information from the purchaser at the time of enquiry and order:

- a) quantity (mass, number of bars) to be delivered;
- b) shape of the product (e. g. round, hexagon, square, flat);
- c) the dimensions and tolerances of the product, see 7.6 and Table 3 and Tables 11 to 13;
- d) a reference to this document, i. e. ISO 16143-4;—:

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- e) the designation of the steel grade;
- f) if for the relevant steel more than one heat treatment condition is possible (for the martensitic and precipitation hardening steels of Table 7), the symbol for the desired heat treatment conditions;
- g) the desired condition (see symbols in Table 2) for steel grades ordered according to Tables 5 to 7 or the cold worked hardened condition for steel grades ordered according to Table 8;
- h) standard designation for a test report 2.2 or, if required, any other type of inspection document in accordance with ISO 10474.

### 6.25.2 Options/Supplementary or special requirements

A number of options are specified in this document and listed below.

- a) ~~Reference~~ testing for products used in the quenched and tempered condition, only for martensitic and precipitation hardening steels ordered in the annealed condition, (see 8.3.1 and C.2);
- b) non-destructive testing (see 7.5 and C.3);
- c) the disposition of tolerances in accordance with 7.6 and C.4;
- d) bar end conditions may be specified at the time of enquiry and order in accordance with C.5;
- e) product analysis (see 7.2, Table 1 and C.6);
- f) any requirement to special marking (see Clauses 10 and C.7),
- g) any additionally requirement concerning the surface condition, i.e. ground surface +G or polished surface +PL for round bars (see 6.2.2 and Table 3); <https://standards.iteh.ai/catalog/standards/sist/bdf0a5f3-fd58-4338-bc74-bdf30bd3f697/iso-16143-4>
- h) surface quality class if another than the standard class is requested (see 7.76 and Table 4);
- i) verification of the straightness (see 7.6, Tables 12 and 13 and Annex D);
- j) impact test at a temperature lower than room temperature (see 9.2.2).

### 6.35.3 Ordering example

3 t round bars with nominal diameter 80 mm, tolerance h8, stock length 6 000 mm made of steel grade X5CrNi18-10 according to this document in process route +2G, surface quality class 3 and a certificate 3.1 as specified in ISO 10474.

**3 t round bars 80 h8 × stock 6 000**

**steel grade ISO 16143-4 - X5CrNi18-10+2G**

**Inspection certificate ISO 10474 - 3.1**

## 76 Manufacturing process

### 7.16.1 General

The manufacturing process of the steel and of the products is, with the restrictions given by the requirements in 6.2 and 6.3, left to the discretion of the manufacturer.

## 7.26.2 Treatment and surface condition at delivery

### 7.2.16.2.1 Treatment condition

The treatment and heat-treatment condition (if any) at the time of delivery shall comply conform with the condition agreed in the order and shall be one of the conditions indicated in Table 2.

### 7.2.26.2.2 Surface conditions

The surface condition and the tolerance classes on bright steel products shall comply conform with Table 3. One of the classes written in brackets can be agreed at the time of enquiry and order if requested by the purchaser.

## 7.36.3 Traceability of the cast

Each product shall be traceable to the cast, see Clause 10.

## 8 Requirements

### 8.17.1 General

Combination of usual treatment conditions at the time of delivery and requirements concerning chemical composition and mechanical properties are shown in Table 2.

In addition to this document, the general technical delivery requirements of ISO 404 shall apply.

### 8.27.2 Chemical composition

The chemical composition of the steels determined by the cast analysis, shall comply conform to ISO 16143-2 and ISO 4955. The grades and the chemical composition of the steels are also listed for information in this document, see Annex A for ISO 16143-2 and ISO 4955.

Permissible deviations between the limiting values for cast analysis and the values for product analysis are given in the corresponding table of ISO 16143-2 and ISO 4955. The product analysis shall be carried out when specified at the time of enquiry and order (see C.6).

### 8.37.3 Mechanical properties

For steels ordered in one of the treatment conditions in Table 2, the requirements for mechanical properties specified in Tables 5 to 7 apply (except for stainless steel bars ordered in condition +2D for which the mechanical properties are to be found in ISO 16143-2 and ISO 4955). The mechanical property values given in Tables 5 to 7 apply to test pieces which that have been taken and prepared in accordance with Figure 1.

For stainless steel bars which are intentionally cold work hardened in order to increase their 0,2-proof strength to a specific level, the mechanical properties at room temperature as specified in Table 8 apply. For these products, the mechanical properties are prime, with the condition a secondary property.

An impact test is to shall be performed for peeled/turned bars if mentioned in the tables of mechanical properties. For cold drawn bars (+2H, +2H+2G, +2H+2P), requirements on impact tests can normally not be performed since there are no reference values, unless impact test and Charpy values are agreed at the time of enquiry and order. Additional requirements concerning the impact energy and the verification at temperatures other than room temperature (0 °C, -20 °C and -40 °C) can be agreed at the time of enquiry and order.

#### 8.57.4 Internal soundness

Where appropriate, requirements relating to the internal soundness of the products shall be agreed at the time of enquiry and order (see C.3).

#### 8.67.5 Shape, dimensions and tolerances

The tolerance class on thickness (and width for flats) shall ~~comply~~ conform with the requirements agreed at the time of enquiry and order and shall be in accordance with Table 3. If there is no agreement on the tolerance class, the bright products are delivered with the standard tolerance class given in Table 3. The tolerance class and the corresponding tolerances are given in Table 9 for rounds, squares and hexagons and in Table 10 for drawn flats. Where specified by the purchaser at the time of enquiry and order, the disposition tolerances specified in Table 9 shall be in accordance with C.4.

Unless otherwise agreed at the time of enquiry and order, the length and the tolerance on length shall be as specified in Table 11.

Maximum deviation from 'ovality' shall be not more than half the specified tolerance range and in any case never above the upper limit of the tolerance. Any requirements concerning out of shape ~~(see 3.7)~~ may be agreed at the time of enquiry and order together with the measurement method.

For the evaluation of straightness, automatic methods can be used at the discretion of the manufacturer. Where specified at the time of enquiry and order and in cases of dispute, an agreed number of bars shall be evaluated for straightness in accordance with one of the methods specified in Annex D. The tolerances specified in Tables 12 and 13 shall apply.

Non-round bars (i.e. square, hexagon and flat) in widths  $\leq 150$  mm may have an undefined profile within a distance of 0,2 mm of the hypothetical edge, and flats in widths  $> 150$  mm within a distance of 0,5 mm, unless otherwise agreed. For widths  $> 150$  mm, sharp corners can specifically ~~be~~ be ordered.

#### 8.77.6 Surface quality

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Bright products shall have a smooth, scale free surface. Bright products in the final heat-treated condition shall be free from loose surface scale; their surface might be discoloured or darker. For hexagons, squares, flats and profiles with special cross-sections, one cannot achieve – for manufacturing reasons – the same quality of surface finish as for round cross-sections.

Since surface discontinuities (cracks, overlapping, scale, isolated pores, pits, grooves, etc.) cannot be completely avoided during manufacturing (hot and cold forming, heat treatments, handling and storage) and since they are retained when drawing, agreements shall be made regarding surface quality. The surface quality of the products shall be one of the classes in accordance with Table 4.

Cold drawn bars are normally delivered in class 1, while peeled/turned bars as well as ground/polished bars are delivered in class 3. Different classes may be agreed at the time of enquiry and order.

For flats, squares in sizes greater than 20 mm and hexagons in sizes greater than 50 mm, the maximum possible depth of surface discontinuities shall be agreed at the time of enquiry and order.

NOTE Where automatic testing of the surface is applied, 50 mm of each end of the bar is not normally covered.

Surface defects cannot be eliminated without removal of material. Products in the 'technically crack free by manufacture' condition are only available in the peeled/turned and/or ground conditions.

## 98 Inspection

### 9.18.1 Testing procedures and types of documents

**8.1.1** Products ~~complying~~conforming with this document shall be ordered and delivered with one of the inspection documents specified in ISO 10474. The type of document shall be agreed upon at the time of enquiry and order. If the order does not contain any specification of this type, a test report 2.2 shall be issued.

**8.1.2** If, in accordance with the agreements made at the time of enquiry and order, a test report 2.2 ~~is~~ **must** be provided, this shall cover the following information:

- a) confirmation that the material complies with the requirements of the order;
- b) results of the cast analysis for all elements specified in Table A.1 for the steel gradetype concerned.

**8.1.3** If, in accordance with the agreements in the order, an inspection certificate 3.1 or 3.2 to ISO 10474 is to be provided, the specific inspections and tests described in 8.3 and Clause 9 shall be carried out and the results shall be confirmed in the inspection certificate.

In addition, the inspection certificate shall cover:

- a) confirmation that the material complies with the requirements of the order;
- b) results of the cast analysis for all elements specified in Table A.1 for the steel gradetype concerned;
- c) the result of all inspections and tests ordered by supplementary requirements (see Annex C);
- d) the symbol letters or numbers relating the inspection certificate, test pieces and products to each other.

### 9.28.2 Frequency of testing

The amount of testing, the sampling conditions and the test methods to be applied for the verification of the requirements shall be in accordance with the prescriptions of Table 1.